

PATENT SPECIFICATION

(11) 1 241 376

DRAWINGS ATTACHED

1 241 376

- (21) Application No. 23440/69 (22) Filed 8 May 1969
 (31) Convention Application No. 38275 (32) Filed 10 May 1968 in
 (33) Japan (JA)
 (45) Complete Specification published 4 Aug. 1971
 (51) International Classification G 07 b 11/02
 (52) Index at acceptance
 G4T 11A 18A1 18D1 18E1 18E3 18G7 18J1 18N
 B8A 1C2K 1C2Q 1C3K 1C3Q 4B 4H1B 4K2A 4MX 4P2Y



(54) IMPROVEMENTS IN OR RELATING TO AUTOMATIC TICKET GATES

- (71) We, OMRON, TATEISI ELECTRONICS Co, a Japanese Body Corporate, of 10 Tsuchido-cho, Hanazono, Ukyoku, Kyoto, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to an automatic ticket gate, and more particularly to improvements in the manner in which the ticket is conveyed from a ticket inlet slot to a ticket outlet slot of the gate.
- There is known an automatic ticket gate, which comprises a pair of opposed elongated structures defining the opposite sides of a gateway to and from an area to which admission is only allowed to a bearer of a specific ticket or card. Any person who wishes to pass through the gate is supposed to insert his ticket into an inlet slot formed at one end of the structures. The ticket is checked with respect to its validity by a suitable device enclosed in the structure and then conveyed in a short time by an appropriate means form a ticket inlet to a ticket outlet. The bearer who inserts his ticket in the inlet slot must receive his own ticket from an outlet slot formed in the opposite end of the structure. If the ticket has been recognised to be false or invalid by the checking device, the gate is closed and/or an alarm is sounded to summon an official in charge of the gate.
- It is desirable in a gate of this kind that the checking of the ticket inserted into the inlet slot should be done quickly so as not to allow the bearer of the ticket or card to pass through the gates before the verification of the ticket finishes. Moreover the verification must be made positively in order not to pass a person having an invalid ticket or card through the gate, and the conveying of the ticket within the structure must be done quickly so that the bearer can easily receive his own ticket from the outlet slot whilst passing through the gate without waiting. Also, returning the ticket from the outlet slot must be done slowly so that the bearer can receive his own ticket positively without injury to his hand by the ticket or without the ticket flying out of the outlet slit. If the gate is so arranged so as to accept many passengers in rapid succession, it should be able to shorten the handling time of a ticket between the moments when the ticket is inserted in the inlet slot and when the ticket is ejected from the outlet slot, so as to improve the efficiency of the gate, and should be such that a plurality of ticket conveying means can cease their operation in the event that any one of said conveying means ceases its operation, so as to avoid confusion in the conveying order of the tickets inserted into the inlet slot.
- The invention, therefore, has for its object the provision of an automatic ticket gate for conveying a ticket from an inlet to an outlet of the gate, wherein the ticket inserted in the inlet can be conveyed to the outlet by a succession of different speeds during which the ticket checking can be performed to enable a handling capacity of a large number of tickets to be achieved.
- According to the invention there is provided an automatic ticket gate including at least one pair of first and second structures parallelly opposed to define a gateway, at least one barrier means disposed at the exit side of either of said structures, an inlet slot formed on an upper portion of said first structure at the entrance, an outlet slot formed on said upper portion at the side of the exit, and a ticket conveyance, housed in said first structure for transporting the ticket, which has been inserted in said inlet slot, to said outlet slot said ticket conveyance comprising a first ticket conveying means consisting of a plurality of couples of driving and driven rollers and drive means for operating said couples of rollers in synchronism so as to feed the ticket away from the inlet slot into the first structure at a low speed, a detector means disposed between said couples of rollers for checking the validity of said ticket inserted, a second ticket conveying means consisting of one pair of driving and driven members opposed to each other to define a passage therebetween and drive means for operating said pair of members so as to feed the ticket, which

has been fed thereto by means of said first conveying means, away from said first conveying means through said passage at a high speed, a third ticket conveying means consisting of a plurality of couples of driving and driven rollers and drive means for operating said couples of rollers in synchronism so as to feed the ticket, which has been fed thereto by means of said second conveying means, away from said second conveying means on to the outlet slot at an intermediate speed, a first switch means disposed immediately below said inlet slot for operating said three drive means upon insertion of the ticket in said inlet slot, a second switch means disposed immediately below said outlet slot for ceasing the operation of each of said three drive means after the ticket passes through said second switch means, and said three drive means being electrically associated with one another in such a manner that, when said second conveying means ceases its operation incidentally, the first mentioned drive means can be de-energized to stop the operation of the first conveying means and, when said third conveying means ceases its operation incidentally, the first mentioned and second mentioned drive means can be de-energized to stop the operation of the first and second conveying means, respectively.

Throughout this specification the term "conveying means" is used to represent a device for transporting the ticket, for example a band conveyor, chain conveyor, roller conveyor or the like.

The preferred embodiment of the invention is designed to make it possible to convey the ticket between the ticket inlet and outlet by a succession of different speeds, by providing more than one ticket conveyor, that is, a plurality of conveying means each being operated at a predetermined speed.

Furthermore, the invention in its preferred form is designed to obtain the most suitable speed at each stage during checking, returning the ticket and treating a plurality of tickets, i.e., a low speed at which the ticket is checked during its passage through the checking means, an intermediate speed at which the ticket is discharged from the ticket outlet and a high speed at which the ticket is conveyed the rest of the length.

Furthermore, in a preferred embodiment, the invention is designed so that the tickets come out from the ticket outlet slowly, by providing brake means in the form of a presser roller disposed directly below the ticket outlet for pressing the ticket downwardly onto a sloping plate to regulate the ticket fed to the outlet. As a still further feature, the device is designed to cause a smooth transfer of the ticket between two conveying means each being driven at a different ticket conveying speed by provid-

ing a roller and gravity-pawl clutch. Furthermore, the device of the invention is designed to make it possible to store the ticket in each conveying means, so that the plurality of conveying means are electrically associated in such a manner as to stop one or two of said conveying means automatically when the following conveying means stops incidentally. As described above, this invention provides a novel automatic ticket gate for conveying the ticket at various speeds for checking, returning and handling the ticket, thereby making the return of the ticket positive.

A specific example of an automatic ticket gate embodying the invention will now be described by way of example and with reference to the accompanying drawings in which:

Figure 1 shows schematically an isometric view of an embodiment of an automatic ticket gate;

Figure 2 is an enlarged, longitudinal section of one of the gateway defining structures of Figure 1 showing the interior mechanism somewhat schematically;

Figure 3 is a top plan view of Figure 2 with part of Figure 2 broken away;

Figure 4 is an isometric view showing the arrangement of parts of a mechanism as shown in Figure 2;

Figure 5 is an enlarged sectional view of a part of Figure 2; and

Figure 6 is a graph showing schematically various conveying speeds relating to the distance from the inlet slot in Figure 2.

Referring initially to Figure 1, there are shown an opposed pair of elongated structures 10 and 11 defining the opposite sides of a gateway 12 positioned, for example, on the platform of a railway station. Passengers pass through the gateway in the direction of an arrow 13. One structure 10 is provided on its upper portion, at the entrance, with an inlet slot 14 for receiving a ticket T thereinto and on its upper portion, at the exit with an outlet slot 15 for returning a ticket therefrom. The structure 10 is provided on the exit side of the gateway with a barrier means 16 which is locked when the ticket T inserted into the inlet slot 14, is found to be invalid by a checking means within the structure, thereby preventing a passenger from passing through the gateway 12. In the illustrated embodiment, the structure 11 only serves to define the opposite side of the gateway 12. However, it may be of the same construction as the structure 10 and perform the same function for a second gateway which may be formed at the side of the structure 11.

Turning to Figure 2, the structure 10 houses between the inlet slot 14 and the outlet slot 15 a first conveying means 17, a second conveying means 18 and third conveying

means 19. The first conveying means 17 comprises a plurality of coupled rollers, having driving rollers 20, 21 and 22 positively rotated together by means of a motor M1. These driving rollers 20, 21, 22 have counterpart driven rollers 23, 24 and 25, each of which is slidably supported by a lever 26, and is biased towards its coupled driving roller by a spring 27. The ticket T inserted into the inlet slot 14 is detected by a detecting switch S1 such as a light source and a photo electric switching device, disposed immediately below the inlet slot 14, the operation of which starts motors M1, M2 and M3. The ticket T is then conveyed downwardly in the structure 10 by the first conveying means 17 at low speed while sandwiched and conveyed between the pairs of driving and driven rollers 20-22, 23-25 whereby the ticket T can be positively checked during its passage through the checking means 28 which is provided between the rollers 21, 24 and 22, 25. The information on the ticket T may be recorded in the form of punched holes arranged in a predetermined code. The checking means 28 may comprise a light source and a photo-electric device which operates in response to the light passing through the punched holes on the ticket T, and reads the information recorded on the ticket T as it passes by and thereby checks its validity. The driving roller 22 of the last stage in the first conveying means 17 comprises a roller and a gravity pawl clutch through which the outer-roller 22a is driven in one direction by the inner roller 22b and is able to free-wheel i.e. freely overrun the inner roller 22b. That is to say, the inner roller 22b is rotated positively by the motor M1, and the outer-roller 22a is driven in the same direction by the inner roller 22b via the clutch so that the ticket T, conveyed in one direction by the outer roller 22a, may outrun against the inner roller 22b in company with the outer roller 22a if it is pulled or pushed in the same direction at a higher speed than that of inner roller 22b by an external force such as being pulled from the second conveying means 18. Accordingly, the roller and gravity pawl clutch enables the ticket to be transferred, without tearing it or damaging it, between the first and second conveying means 17 and 18 having a different ticket conveying speed to each other. The ticket that has passed the checking means 28 by the first conveying means 17 is then brought onto the second conveying means 18 through the roller and gravity pawl clutch. The checking means 28 provided below the inlet slot 14 enables the ticket inserted into the inlet slot 14 to be quickly checked so that the barrier 16 of the gateway may be locked, depending on the validity of the ticket, before the passenger passes through the gateway. Also, the first conveying means 17, makes it possible to check the ticket positively by using a low speed for checking the ticket during its passage through the checking means, so that the barrier 16 of the gateway may be positively either unlocked for admitting a person having a valid ticket or locked for refusing a person having an invalid ticket. Moreover, the first conveying means 17 makes it possible to store tickets therein when the motor M1 is stopped incidentally immediately after stopping of the following conveying means, so that confusion may be avoided in the conveying order of the tickets inserted in succession into the inlet slot.

The second conveying means 18 comprises a pair of endless belts 29 and 30. The driving belt 29 is passed about a pair of pulleys 31 and 32 and is rotated positively by means of a motor M2, and the driven belt 30 is passed about a pair of pulleys 33 and 34, the two belts being kept taut by tension rollers 35 and 36. The ticket T is sandwiched and conveyed between the pair of driving and driven belts at high speed so as to send the ticket T from the first conveying means 17 to the third conveying means 19. As the length of the second conveying means 18 is nearly as long as the distance between the inlet slot 14 and the outlet slot 15 of the structure, the greater part of the distance over which the ticket is conveyed (i.e. from the inlet slot 14 to the outlet slot 15 in the structure) is by the second conveying means. Accordingly, the faster the second conveying means is driven by the motor M2, the shorter is the time during which the ticket is conveyed in the structure, and the passenger can receive his own ticket, which has been inserted into the inlet slot 14, from the outlet slot 15 whilst passing through the gate and without waiting, thereby improving the passenger handling efficiency. In the same way as with the first conveying means 17, the second conveying means 18 can store the ticket T therein when the motor M2 is stopped incidentally immediately after stopping of the following conveying means, so that confusion may be avoided in the conveying order of the tickets that have been sent in succession from the first conveying means. The ticket that has been conveyed by the second conveying means 18 is then brought onto the third conveying means 19.

The third conveying means 19 comprises, similar to the first conveying means, a plurality of coupled rollers, having driving rollers 37, 38 and 39 rotated positively together by means of a motor M3. These driving rollers 37, 38, 39 have counterpart driven rollers 40, 41 and 42, each of which is slidably supported by a lever 43 (see Figure 5) and is biased towards its coupled driving roller by a spring 44. The ticket T is sandwiched and conveyed upwardly between

these pairs of driving and driven rollers at low speed so that the ticket comes out slowly to the outlet 15. The driving roller 37 of the first stage in the third conveying means 19 is a roller with a gravity-pawl clutch. As described above, the roller and gravity-pawl clutch enables the ticket to be transferred, without tearing it or damaging it, between the second and third conveying means 18 and 19 driven at different ticket conveying speeds. The ticket T that has been brought under the outlet slot by the third conveying means 19 is caused to be hurled onto a sloping plate 45, while its rear or lower end comes to rest on a projection 46 formed on the lower end of the plate 45, so that the ticket is held there, with its forward or upper end peeping out of the outlet slot ready to be pulled out therefrom. A brake means comprising a presser roller 47 with a spring 48 is provided on the sloping plate 45 for pressing the ticket hurled thereunder downwardly so as to decrease the inertia speed of the ticket, so that the ticket comes more slowly out of the outlet slot and does not fly out or be projected from the machine. Therefore, the cooperation of the third conveying means 19 and the brake means make it possible in a short time to slow down and then stop the ticket sent at high speed from the second conveying means, thereby precluding the possibility of hurting the ticket receiver's hand by the ticket flying out of the outlet slot, and thus holding the ticket positively on the sloping plate of the outlet slot. The ticket as it is ejected from the outlet slot is detected by the detecting switch S2, such as a light source and a photo-electric switching device, disposed immediately below the outlet slot 15, the operation of which stops the motor M3, and then motor M2 and M1 in succession.

In Figure 6, as one example, is shown schematically the various conveying speeds V of the three conveying means relating to distances L from the inlet slot thereof. At the inlet slot most tickets are effectively inserted at zero speed. On the first conveying means of approximately 270 millimeters length the ticket is carried at low speed approximately 1000 millimeters a second, the speed being controlled by the motor M1. On the second conveying means of approximately 990 millimeters length the ticket is carried at high speed approximately 3000 millimeters a second by the motor M2. On the third conveying means of approximately 60 millimeters length the ticket is carried at medium speed of approximately 1500 millimeters a second by the motor M3, and at the outlet slot the ticket is stopped that is at zero speed. From the inlet slot to the first conveying means for approximately 170 millimeters length the ticket is accelerated slowly, but from the third conveying means to the outlet slot of approximately 60

millimeters length the ticket is decelerated quickly by the brake means. The ticket is transferred immediately between the first conveying means, the second conveying means and the third conveying means by the roller and gravity-pawl clutch. On such a structure as that hereinbefore described of which the length is about 1.55 meters, the consumed time of the ticket to complete the journey through the structure is about 1.06 seconds.

WHAT WE CLAIM IS:—

1. An automatic ticket gate including at least one pair of first and second structures parallelly opposed to define a gateway, at least one barrier means disposed at the exit side of either of said structures, an inlet slot formed on an upper portion of said first structure at the entrance, an outlet slot formed on said upper portion at the side of the exit, and a ticket conveyance, housed in said first structure for transporting the ticket, which has been inserted in said inlet slot, to said outlet slot said ticket conveyance comprising a first ticket conveying means consisting of a plurality of couples of driving and driven rollers and drive means for operating said couples of rollers in synchronism so as to feed the ticket away from the inlet slot into the first structure at a low speed, a detector means disposed between said couples of rollers for checking the validity of said ticket inserted, a second ticket conveying means consisting of one pair of driving and driven members opposed to each other to define a passage therebetween and drive means for operating said pair of members so as to feed the ticket, which has been fed thereto by means of said first conveying means, away from said first conveying means through said passage at a high speed, a third ticket conveying means consisting of a plurality of couples of driving and driven rollers and drive means for operating said couples of rollers in synchronism so as to feed the ticket, which has been fed thereto by means of said second conveying means, away from said second conveying means on to the outlet slot at an intermediate speed, a first switch means disposed immediately below said inlet slot for operating said three drive means upon insertion of the ticket in said inlet slot, a second switch means disposed immediately below said outlet slot for ceasing the operation of each of three drive means after the ticket passes through said second switch means, and said three drive means being electrically associated with one another in such a manner that, when said second conveying means ceases its operation incidentally, the first mentioned drive means can be de-energized to stop the operation of the first conveying means and, when said

third conveying means ceases its operation incidentally, the first mentioned and second mentioned drive means can be de-energized to stop the operation of the first and second conveying means, respectively.

5 2. An automatic ticket gate as claimed in claim 1, wherein one driving roller of the last stage of the couples of said rollers for the first conveying means comprises a roller provided with a gravity-pawl clutch, whereby the ticket
10 to be transported from the first conveying means to the second conveying means can be smoothly transferred in spite of change in the ticket feeding speed.

15 3. An automatic ticket gate as claimed in claim 1, wherein one driving roller of the initial stage of the couples of said rollers for the third conveying means comprises a roller provided with a gravity-pawl clutch, whereby
20 the ticket to be transported from the second conveying means to the third conveying

means can be smoothly transferred in spite of change in the ticket feeding speed.

4. An automatic ticket gate as claimed in claim 1 further comprising braking means for preventing the sudden ejection of the ticket from the outlet slot, said means consisting of a sloping plate and a presser roller normally biased toward said sloping plate by means of a resilient member so as to sandwich the ticket between the adjacent surface of said sloping plate and said presser roller.

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Reference has been directed in pursuance of Section 9, Sub-section (1) of the Patents Act, 1949, to patent No. 1,181,554.

COMPLETE SPECIFICATION

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 1

FIG. 3

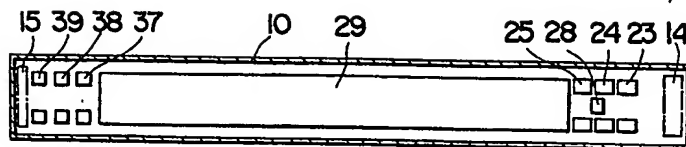


FIG. 4

